

CLAIMS

What is claimed is:

1. A process of producing a carbon foam heat sink comprising:
 - selecting an appropriate mold shape;
 - introducing pitch to an appropriate level in said mold;
 - purging air from said mold to form a vacuum;
 - heating said pitch to a temperature sufficient to coalesce said pitch into a liquid;
 - releasing said vacuum and backfilling an inert fluid at a static pressure up to about 1000 psi;
 - heating said pitch to a temperature sufficient to cause gases to evolve and form a carbon foam;
 - heating said carbon foam to a temperature sufficient to coke the pitch;
 - cooling said carbon foam to room temperature and simultaneously releasing said inert fluid;
 - at least partially encasing said carbon foam; and
 - at least partially filling porous regions of said carbon foam with a phase change material.
2. The process of claim 1 wherein said pitch is introduced as granulated pitch.
3. The process of claim 1 wherein said pitch is introduced as powdered pitch.
4. The process of claim 1 wherein said pitch is introduced as pelletized pitch.
5. The process of claim 1 wherein said pitch is a synthetic mesophase or isotropic pitch.
6. The process of claim 1 wherein said pitch is a petroleum derived mesophase or isotropic pitch.
7. The process of claim 1 wherein said pitch is a coal-derived mesophase or isotropic pitch.

8. The process of claim 1 wherein said pitch is a blend of pitches selected from the group consisting of synthetic mesophase or isotropic pitch, petroleum derived mesophase or isotropic pitch, and coal derived mesophase or isotropic pitch.
9. The process of claim 1 wherein said pitch is a solvated pitch.
10. The process of claim 1 wherein said purging is effected by a vacuum step.
11. The process of claim 1 wherein said purging is effected by an inert fluid.
12. The process of claim 1 wherein said vacuum is applied at less than 1 torr.
13. The process of claim 1 wherein nitrogen is introduced as the inert fluid.
14. The process of claim 1 wherein said pitch is heated to a temperature in the range of about 500°C to about 1000°C to coke said pitch.
15. The process of claim 1 wherein said pitch is heated to a temperature of about 800°C to coke said pitch.
16. The process of claim 1 wherein the temperature to coke said pitch is raised at a rate of no greater than 5°C per minute.
17. The process of claim 1 wherein said pitch is soaked at the coking temperature for at least 15 minutes to effect said coking.
18. The process of claim 1 wherein said pitch is heated to a temperature of about 630°C to coke said pitch.
19. The process of claim 1 wherein said pitch is heated to a temperature of about 50°C to about 100°C to coalesce said pitch.

20. The process of claim 1 where said foam is cooled at a rate of approximately $1.5^{\circ}\text{C}/\text{min}$ with the release of pressure at a rate of approximately 2 psi/min.
21. The process of claim 1 further including the step of densifying said foam.
22. The process of claim 1 wherein said phase change material is acetic acid.
23. The process of claim 1 wherein said phase change material is a paraffin wax.
24. The process of claim 1 wherein said phase change material is germanium.
25. The process of claim 1 wherein said encasement material is polyethylene.
26. The process of claim 1 wherein said encasement material is aluminum.
27. The process of claim 1 wherein said encasement material is a carbon-carbon composite.
28. A carbon foam heat sink product as produced by the process of claim 1.
29. A process of producing a carbon foam heat sink comprising:
 - selecting an appropriate mold shape and a mold composed of a material that the molten pitch does not wet;
 - introducing said pitch to an appropriate level in the mold;
 - purguing the air from said mold to form a vacuum;
 - heating said pitch to a temperature sufficient to coalesce said pitch into a liquid;
 - releasing said vacuum and backfilling an inert fluid at a static pressure up to about 1000 psi;
 - heating said pitch to a temperature sufficient to coke the pitch; and
 - cooling said foam to room temperature and simultaneously releasing said inert fluid;
 - at least partially encasing said foam; and

at least partially filling porous regions of said foam with a phase change material.

30. The process of claim 29 wherein said pitch is introduced as granulated pitch.
31. The process of claim 29 wherein said pitch is introduced as powdered pitch.
32. The process of claim 29 wherein said pitch is introduced as pelletized pitch.
33. The process of claim 29 wherein said pitch is a synthetic mesophase or isotropic pitch.
34. The process of claim 29 wherein said pitch is a petroleum-derived mesophase pitch.
35. The process of claim 29 wherein said pitch is a coal-derived mesophase pitch.
36. The process of claim 29 wherein said mold is purged by a vacuum applied at less than 1 torr.
37. The process of claim 29 wherein said mold is purged by an inert fluid before heating.
38. The process of claim 29 wherein said phase change material is acetic acid.
39. The process of claim 29 wherein said phase change material is a paraffin wax.
40. The process of claim 29 wherein said phase change material is germanium.
41. The process of claim 29 wherein said encasement material is polyethylene.
42. The process of claim 29 wherein said encasement material is aluminum.
43. The process of claim 29 wherein said encasement material is a carbon-carbon composite.
44. A carbon foam heat sink product as produced by the process of claim 29.

45. A process of producing a carbon foam heat sink comprising:
 - selecting an appropriate mold shape;
 - introducing pitch to an appropriate level in said mold;
 - purging air from said mold to form a vacuum;
 - heating said pitch to a temperature sufficient to coalesce said pitch into a liquid;
 - releasing said vacuum and backfilling an inert fluid at a static pressure up to about 1000 psi;
 - heating said pitch to a temperature sufficient to cause gases to evolve and form carbon foam;
 - heating said carbon foam to a temperature sufficient to coke the pitch;
 - cooling said carbon foam to room temperature and simultaneously releasing said inert fluid;
 - placing facesheets on the opposite sides of said carbon foam;
 - adhering the facesheets to said carbon foam;
 - at least partially encasing said carbon foam and facesheets; and
 - at least partially filling porous regions of said carbon foam with a phase change material.
46. The process of claim 45 wherein the adhering of the facesheets to the carbon foam is effected by a molding step.
47. The process of claim 45 wherein the adhering of the facesheets to the carbon foam is effected by a coating material.
48. The process of claim 45 wherein said phase change material is acetic acid.
49. The process of claim 45 wherein said phase change material is a paraffin wax.
50. The process of claim 45 wherein said phase change material is germanium.
51. The process of claim 45 wherein said encasement material is polyethylene.

52. The process of claim 45 wherein said encasement material is aluminum.

53. The process of claim 45 wherein said encasement material is a carbon-carbon composite.

54. The process of claim 45 wherein said faesheets material is a carbon-carbon composite.

55. A composite carbon foam heat sink product produced by the process of claim 45.

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